

(19) 日本国特許庁 (J P)

(12) 公表特許公報 (A)

(11) 特許出願公表番号  
特表2003-516214  
(P2003-516214A)

(43) 公表日 平成15年5月13日 (2003. 5. 13)

| (51) Int.Cl. <sup>7</sup>         | 識別記号 | F I           | テマコード* (参考)     |
|-----------------------------------|------|---------------|-----------------|
| A 6 1 B 5/055                     |      | H 0 1 F 5/00  | C 4 C 0 9 6     |
| A 6 1 M 25/00                     |      | A 6 1 B 5/05  | 3 9 0 4 C 1 6 7 |
| G 0 1 R 33/28                     |      |               | 3 3 1           |
| 33/34                             |      |               | 3 5 0           |
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(21) 出願番号 特願2001-544045(P2001-544045)  
(86) (22) 出願日 平成12年11月24日 (2000. 11. 24)  
(85) 翻訳文提出日 平成14年6月7日 (2002. 6. 7)  
(86) 国際出願番号 P C T / I L 0 0 / 0 0 7 8 5  
(87) 国際公開番号 W O 0 1 / 0 4 2 8 0 7  
(87) 国際公開日 平成13年6月14日 (2001. 6. 14)  
(31) 優先権主張番号 9 9 2 9 0 7 0 . 2  
(32) 優先日 平成11年12月8日 (1999. 12. 8)  
(33) 優先権主張国 イギリス (G B)

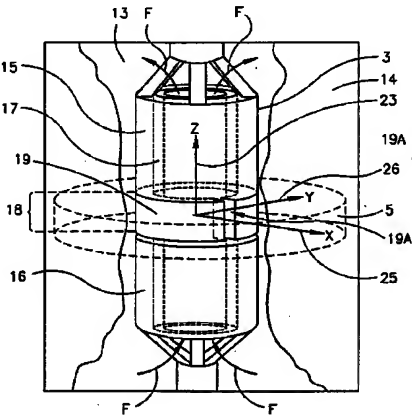
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(54) 【発明の名称】 磁気共鳴撮像装置

(57) 【要約】

周囲を取り囲む媒質のNMR計測と撮像を行うための装置および方法を提供する。該方法は、実質的に非均質な、一次外部磁場の少なくとも1つの領域内からの磁気共鳴信号の検出を利用している。



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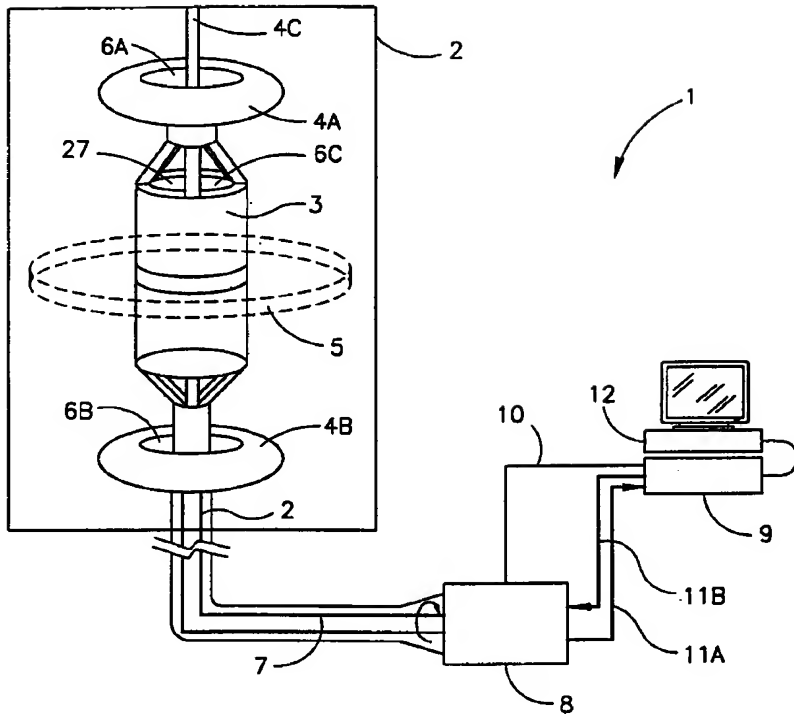
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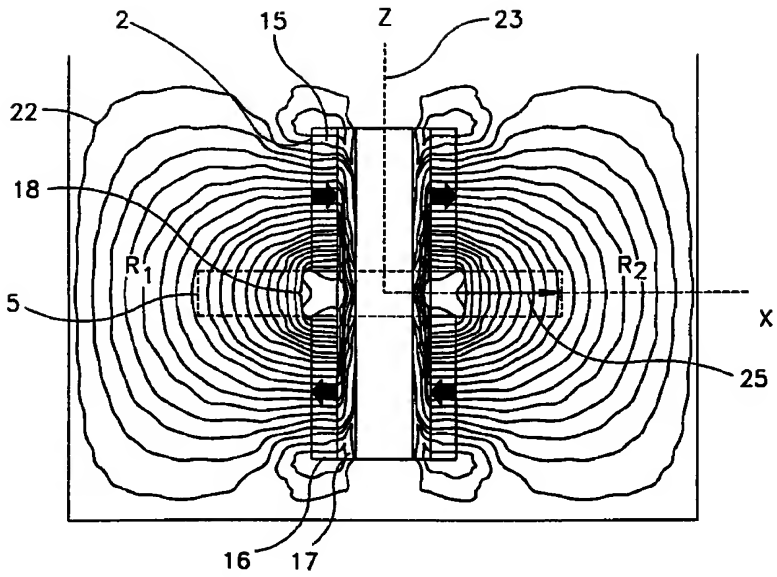
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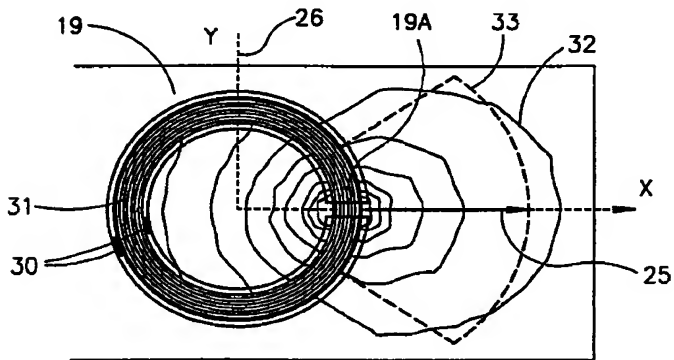




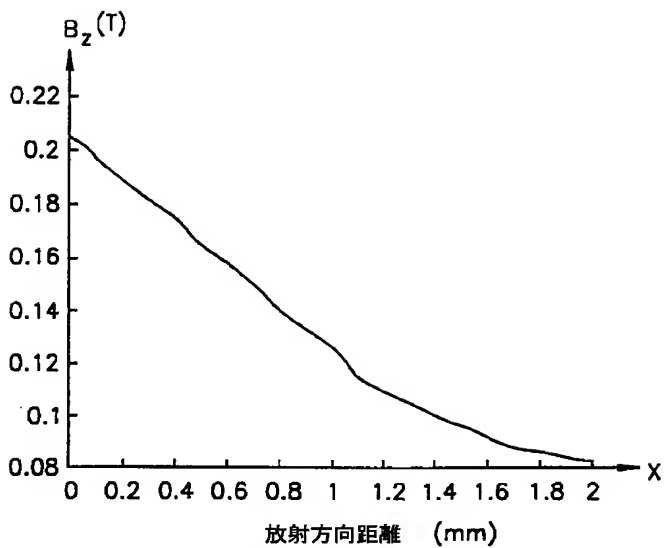
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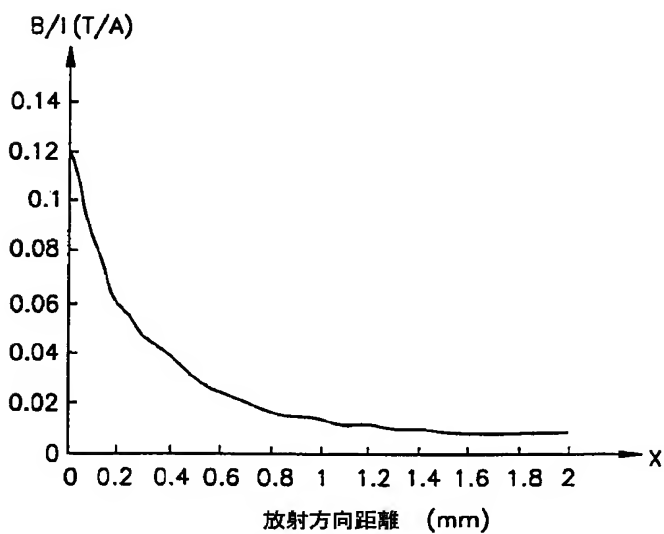
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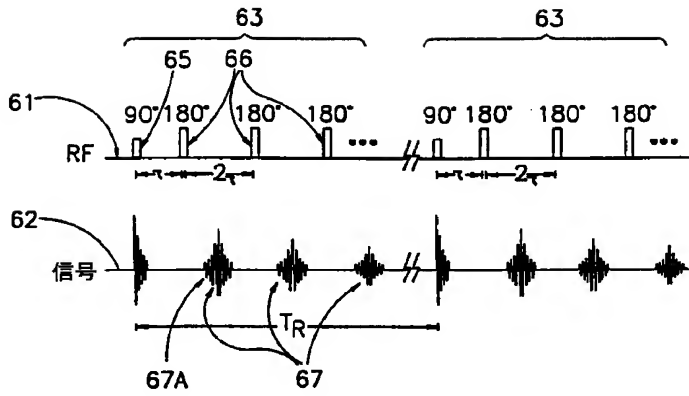
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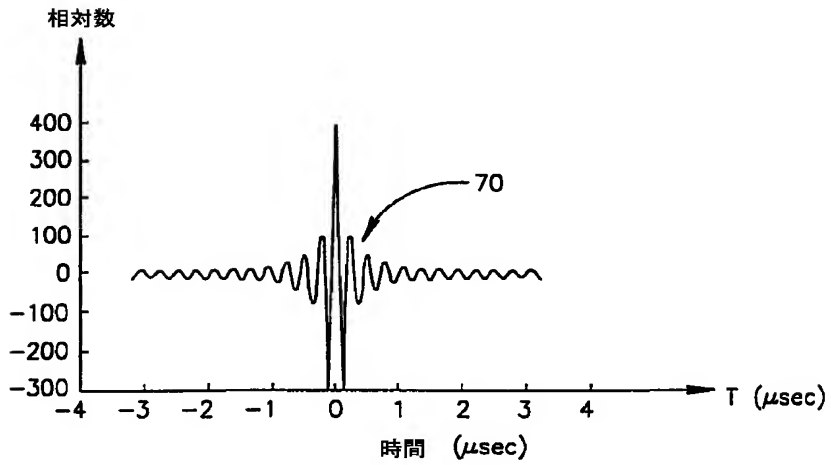
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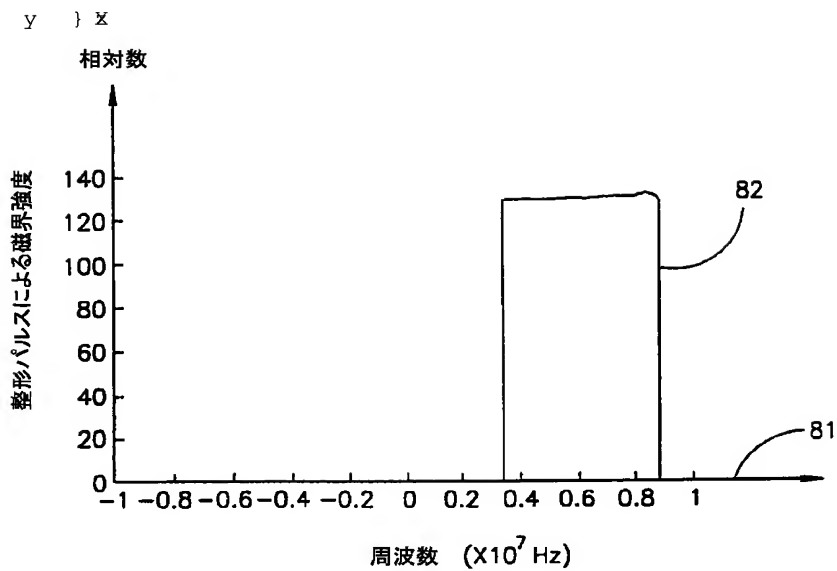
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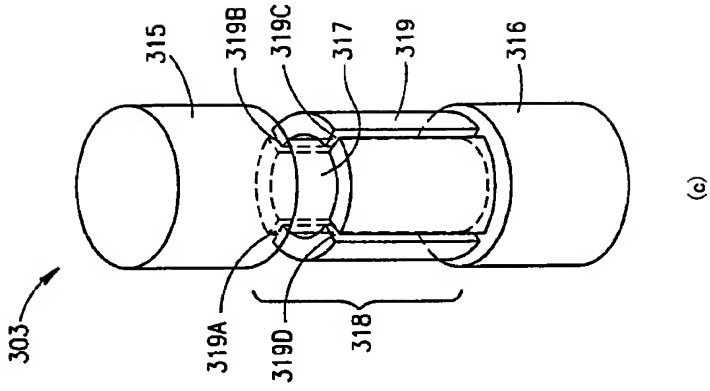
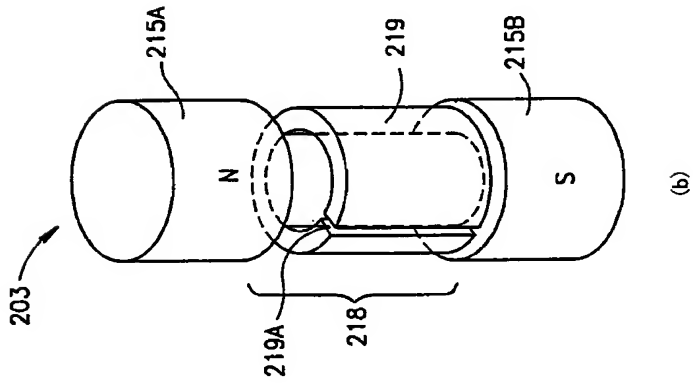
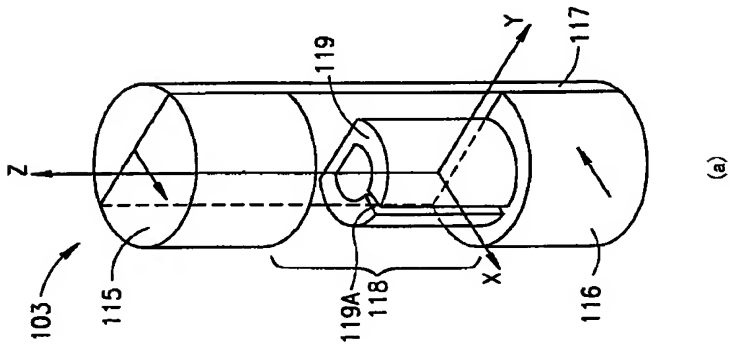




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## INTERNATIONAL SEARCH REPORT

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| Intern. Application No.<br>PCT/IL 00/00785                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                   |
| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>IPC 7 G01R33/28 G01R33/34 G01R33/44 G01V3/32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                   |
| According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                   |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>IPC 7 G01R G01V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                   |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                   |
| Electronic data base consulted during the international search (name of data base and, where practical, search terms used)<br>EPO-Internal, WPI Data, BIOSIS, COMPENDEX, PAJ, INSPEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                   |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                   |
| Category *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document, with indication, where appropriate, of the relevant passages<br>Relevant to claim No.                                                                                                       |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US 5 572 132 A (PULVER YULY M ET AL)<br>5 November 1996 (1996-11-05)<br>cited in the application<br>column 3, line 21 -column 3, line 25<br>column 4, line 51 -column 9, line 56;<br>figures 1,2,5-7,9,10<br>1-25 |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US 4 717 877 A (TAICHER ZVI ET AL)<br>5 January 1988 (1988-01-05)<br>cited in the application<br>column 8, line 28 -column 9, line 54;<br>figures 1,2<br>1-25                                                     |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US 5 023 554 A (CHO ZANG-HEE ET AL)<br>11 June 1991 (1991-06-11)<br>column 11, line 4 -column 12, line 34<br>column 13, line 57 -column 15, line 10;<br>figures 4,5,11-14<br>1-25                                 |
| -/-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> Patent family members are listed in annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                   |
| * Special categories of cited documents :<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier document but published on or after the international filing date<br>"L" document which may throw doubts on priority claims) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is considered with one or more other such documents, such combination being obvious to a person skilled in the art.<br>"S" document member of the same patent family |                                                                                                                                                                                                                   |
| Date of the actual completion of the international search<br>6 June 2001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Date of mailing of the international search report<br>05.07.01                                                                                                                                                    |
| Name and mailing address of the ISA<br>European Patent Office, P.B. 5616 Palantien 2<br>NL - 2200 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax. (+31-70) 340-3316                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Authorized officer<br>Lersch, W                                                                                                                                                                                   |



## INTERNATIONAL SEARCH REPORT

 Internat. Appl. No.  
PCT/IL 00/00785

| C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                                                                                                                               |                       |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Category *                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                            | Relevant to claim No. |
| A                                                     | US 4 714 881 A (GIVENS WYATT W)<br>22 December 1987 (1987-12-22)<br>column 4, line 4 -column 5, line 34;<br>figures 2-5                                                                                                                                       | 1-25                  |
| A                                                     | US 5 610 522 A (LOCATELLI MARCEL ET AL)<br>11 March 1997 (1997-03-11)<br>column 4, line 1 -column 4, line 61<br>column 5, line 17 -column 5, line 24;<br>figures 4-6,9                                                                                        | 1-25                  |
| A                                                     | US 4 629 986 A (CLOW HUGH ET AL)<br>16 December 1986 (1986-12-16)<br>column 2, line 12 -column 4, line 9;<br>figures 1,2C                                                                                                                                     | 1-25                  |
| E                                                     | FR 2 793 882 A (COMMISSARIAT ENERGIE<br>ATOMIQUE) 24 November 2000 (2000-11-24)<br>page 4, line 14 -page 6, line 13; figures<br>4,5                                                                                                                           | 1-27                  |
| X                                                     | US 4 590 427 A (FUKUSHIMA EIICHI ET AL)<br>20 May 1986 (1986-05-20)<br>column 5, line 10 -column 6, line 44<br>column 7, line 19 -column 8, line 10;<br>figures 1-3,9-11                                                                                      | 26,27                 |
| X                                                     | MARINO R A ET AL: "ENHANCED COUPLING TO<br>SMALL NMR SAMPLES USING FERRITE COILS"<br>JOURNAL OF MOLECULAR STRUCTURE, ELSEVIER,<br>AMSTERDAM, NL,<br>vol. 58, January 1980 (1980-01), pages<br>79-83, XP000986387<br>ISSN: 0022-2860<br>see the whole document | 26,27                 |
| P, X                                                  | EP 1 006 366 A (COMMISSARIAT ENERGIE<br>ATOMIQUE) 7 June 2000 (2000-06-07)<br>column 6, line 7 -column 6, line 42;<br>figures 3-5                                                                                                                             | 26,27                 |

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IL 00/00785**Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☒ Claims Nos.: 1-25  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 1-25

No meaningful search is possible for claims 1-25 since (i) the broadness of the claims is not at all supported by the disclosure which covers only a small part of the scope of the claims, (ii) the claims are not clear (Article 6 PCT), (iii) there is a lack of conciseness (e.g., there are four independent device claims of similar scope, viz. claims 5 and 23-25) and (iv) the initial phase of the search revealed such a large number of documents relevant to the issue of novelty of the concept of acquiring NMR signals in a substantially inhomogeneous magnetic field that it is impossible to determine which parts of the claims may be said to define subject-matter for which protection might legitimately be sought (Article 6 PCT). The following list of objections concerning lack of clarity of the scope of the claims is exemplary rather than exhaustive.

Claim 1: It is not apparent what is meant by "substantially non-homogeneous". No magnetic field is perfectly homogeneous and the degree of inhomogeneity depends on the size of the sampling volume which is left unspecified in claim 1. The expression "substantially non-homogeneous", therefore, appears to be meaningless. Furthermore, it is not apparent from claim 1 how the magnetic resonance signals to be detected come about, and what the specific meaning of the terms "primary" and "external" is.

Claim 2: It is not clear which signals are "simultaneously detected".

Claim 5: The formulation "producing ... signals coming from a medium ... and detecting the produced signals" is obscure. Also, it is not clear what "the probe dimensions" are.

Claim 6: It is not clear what "the direction of the primary magnetic field in said ... region" is.

Claim 7: It is not clear of what the segment is a segment.

Claim 15: The features of this claim would appear to be included already in claim 5 upon which claim 15 depends since a "transceiver" is normally used both for transmission and reception.

Claim 16: It is not apparent what defines "said at least one coil gap".

Claim 22: It is not clear whether the "therapeutic or diagnostic device" as a whole is claimed.

Claim 23: It is not apparent what is being transmitted by the "transmission pulses" (e.g., optical transmission?). Moreover, features are lacking which are essential for the device to be capable of generating images (e.g., gradient coils).

Claim 25: It is not clear what an "imaging slice within an annular radial space" and "a segment like region" are. Also, it is not clear how the gap

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

plane can be at the same time parallel and perpendicular to the z-axis ("coil gap located in a plane substantially perpendicular to the Z-axis such that the coil gap plane is substantially parallel to the Z-axis").

In addition to the obscurities of the claims themselves, the general statements on page 21, lines 18-26 of the description render the scope of the claims even more obscure.

In view of the above problems with the scope of the claims, the claims themselves have not been searched (although, for technical reasons, all of the documents cited in the search report are called "A"-documents for claims 1-25). Rather, the search has been carried out only on the basis of the specific examples disclosed in the description and depicted in figs. 1-10 of the drawings.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

International Application No. PCT/IL 00 00785

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. Claims: 1-25

Detection of NMR signals in a non-homogeneous magnetic field

## 2. Claims: 26,27

RF coil wound on a toroidal core

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat. Patent Application No

PCT/IL 00/00785

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|----------------------------------------|------------------|-------------------------|------------------|
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|                                        |                  | DE 3411521 A            | 25-10-1984       |
|                                        |                  | FR 2562250 A            | 04-10-1985       |
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` U P a 5/055 (2006.01)  
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